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# The Obstacles to the Modernization of Common Support Equipment

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THESIS

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## Abstract

The current fleet of Common Support Equipment (CSE) is faced with a $2 billion funding disconnect that threatens nine of the twelve Core Functions of the United States Air Force. The purpose of this research is to identify and explore the factors within the sustainment, acquisition, and maintenance communities that exist as barriers to efforts to modernize CSE across the Air Force Logistics Enterprise. Using a qualitative, grounded theory methodology, this study explores the responses of interviewed Aviation Support Equipment managers responsible for the sustainment and modernization of CSE. The analysis exposed significant barriers to current modernization efforts, resulting in expensive, outdated, duplicative, and unreliable equipment in use across the Air Force. This research concludes that the Air Force must change the way CSE is administrated, funded, and culturally understood to prevent future mission degradation and failure.

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J. Erik Ritschard

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# THE OBSTACLES TO THE MODERNIZATION OF COMMON SUPPORT EQUIPMENT

## I. Introduction

### Background

The Air Force pays $150,000 to refurbish a 1970s-era MJ-1 "Jammer," though a brand new one costs $85,000 (Richards, 2020). Even more wasteful, the E4-B "Nightwatch" National Airborne Operations Center runs one of its engines around the clock on alert because the ground power cart available is too unreliable. This results in the unnecessary consumption of $1.5 million of fuel *per month* (Haralson, 2020). The HH-60G "Pavehawk" aborts 2% of its missions due to preventable radar altimeter discrepancies—the available commercial test set is not approved for Air Force purchase (Ray, 2020). These examples provide a small sample of the current state of Air Force Aviation Support Equipment: expensive, unreliable, and outdated.

A large portion of equipment in-use today was designed and built in the 1960s, 70s, and 80s—long before most currently-serving Airmen were born. This equipment breaks frequently and necessitates "Flightline Heroics" to accomplish the mission (Bobic, 2018). Maintenance technicians and operators across the Air Force are keenly aware of the obstacles to their mission; hampered by bureaucratic processes and funding constraints that prevent their highest priorities from being addressed (Bobic, 2018).

Aviation Support Equipment (AvSE) performs a vital role in the weapon system hierarchy of every aircraft (Swain, 2021). The DoD defines AvSE as: all equipment, whether mobile or fixed, necessary to support the operation and maintenance of a weapon system in every operational circumstance, environment, and level of maintenance

(Taylor, 2020). Common Support Equipment (CSE) consists of all items of AvSE that are utilized by multiple weapon systems. CSE's current portfolio contains more than 533,000 end items, with 53,000 unique stock numbers valued at over $13 billion (Sillence, 2020; Haralson, 2020).

Nine of the twelve Core Functions of the Air Force are directly supported by CSE. Without adequate CSE support, the missions of Air Superiority, Command and Control, Education and Training, Global Integrated Intelligence, Surveillance, and Reconnaissance, Global Precision Attack, Nuclear Deterrence Operations, Personnel Recovery, Rapid Global Mobility, and Special Operations are not possible (Sillence, 2020).

Three distinct Air Force Materiel Command (AFMC) organizations hold responsibility for the management of CSE under the authority of program action directive (PAD) and Air Force Instruction (AFI) HQ AFMC/A4 (PAD 07-13), AFSC/635 SCOW (PAD D16-03), and AFPEO/ACS (AFI 63-101_20-101) (Sillence, 2020). These three organizations form the management "triad" responsible for the cradle-to-grave lifecycle management of all CSE assets.

Functioning as the Weapon System Team (WST), HQ AFMC/A4M (referred to as A4M), provides Lead Command authority and management by establishing policy and guidance, Technical Order (TO) management, and requirement validation for spares, prioritization, and depot repairs (Sillence, 2020). The members of the A4M team provide the vision and direction for all AF CSE assets.

The second organization in the triad is the 635$^{th}$ Supply Chain Operations Wing (SCOW). Responsible for parts management of fielded CSE, the SCOW coordinates

current assets' sustainment through spare parts acquisition (Sillence, 2020). Redistribution Orders (RDO) leveling and transferring assets are also accomplished by the SCOW.

The Air Force Program Executive Office Agile Combat Support (AFPEO/ACS) forms the third leg of the CSE triad (Sillence, 2020). The Support Equipment and Vehicles (SE&V) office under AFPEO/ACS provides CSE items with single-source management of TO accuracy, cybersecurity, and obsolescence prevention (Sillence, 2020). Intended to maximize commonality and leverage efficiencies of scale, SE&V provides the acquisition and modernization oversight of all CSE items (Sillence, 2020). These three organizations refer to CSE modernization as the procurement of "new-new" assets and the acquisition of replacement items as "new-old" (Richards, 2020; Haralson, 2020; Sillence, 2020; Swain, 2021).

As the triad has addressed the field's concerns in recent years, managers at all enterprise levels have been forced into obstacle cycles, preventing them from modernizing CSE and hampering the execution of flightline maintenance. Obstacle cycles, the focus of this research, are hurdles that exist in the process of modernization. These obstacles obscure the process, making a successful modernization project highly unlikely. A thorough review of the existing literature has revealed a gap in the conversation about AvSE—discussion about the obstacles to CSE modernization.

To eliminate ambiguity, modernization must be defined for the purposes of this study. The acquisition community refers to Air Force Pamphlet (AFPAM) 63-128 for key definitions. The term most similar to the common use of modernization in AFPAM63-128 is "modification," defined as "a change to the form, fit, function, or interface of an

in-service…AF asset" (Department of the Air Force, 2014). The policy also defines modifications as activities that provide new capabilities, improve reliability, reduce cost, and enhance operational effectiveness. In this thesis, the term "modernization" is interchangeable with the AFPAM63-128 term "modification."

Based on interviews, site visits, and data provided by Subject Matter Experts (SMEs), this research will outline the critical obstacles to modernization, discuss the likely consequences of an outdated fleet of CSE, and provide recommendations to catalyze the modernization of CSE.

**Problem Statement**

Current policies and procedures have produced an outdated, unreliable CSE fleet with a funding disconnect of $2 billion (Haralson, 2020). Capability gaps exist that prevent the loading and employment of next-generation weapons (Sillence, 2020). The Air Force does not publish a consolidated list of the AvSE required to support its missions and is unable to produce hard metrics to articulate priorities, requirements, and capability gaps, relying instead on anecdotal evidence (Haralson, 2020). The maintenance "no-fail" mentality has masked deep problems in the current equipment fleet, obscuring a clear view of the actual situation (Bobic, 2018). Communication about AvSE needs is so ineffective that the Air Force paid a contractor to facilitate a consolidated priority list between an owning MAJCOM and front-line maintainers (Layne, 2020). These problems do not exist due to a lack of commitment by managers and maintainers, but due to policy requirements that force change-agents into endless cycles, only to be met by an obstacle that prevents modernization.

## Purpose Statement

The purpose and primary goal of this analysis is to identify and explore the obstacles to modernization faced by SMEs in the CSE logistics enterprise through interviews and data collection. The resulting analysis will recommend policy and funding changes to remedy shortfalls in Common Support Equipment modernization objectives.

## Research Questions

RQ 1: What are the top five obstacles to Common Support Equipment modernization?

RQ 2: What are the consequences to the Air Force mission and objectives due to those obstacles?

RQ 3: What actions should Air Force policy-makers take to address those obstacles?

## Research Focus

A review of the current National and Air Force priorities will provide context to logistics and acquisition professionals' operating environment. The literature review of Air Force Support Equipment instruction and policy will provide the written bounds of the management triad. Previous AvSE research is then explored to ensure a thorough review of the topic. Subsequently, the methodological tools and data collection process of this analysis are described. The paper concludes with research findings, limitations, and areas for future research.

## Methodology

This research was accomplished using qualitative interviews and the collection of current Air Force documents and other materials. The qualitative approach employed was influenced by the framework described in the books: *Research Design: Qualitative,*

*Quantitative, and Mixed Methods Approaches* and *Practical Research: Planning and Design* (Creswell, 2014; Leedy & Ormrod, 2015).

## Assumptions

This thesis assumes that each interviewed AvSE manager described the enterprise's actual state and that the described events, numbers, and details represent an accurate perspective. The analysis is founded upon a lack of personal agenda on the part of the interviewees. Additionally, it is assumed that outdated AvSE directly affects a unit's ability to deploy and effectively execute its tasked mission, based on the conclusions of previous authors (Barrett, 2015; Bayer, 2003; Bobic, 2018; Leighton, 2017; O'Donnell & Forster, 1975; Williams, 1991). Finally, the proliferation of peculiar equipment and supplies is assumed to increase cost, based on prior research (Leighton, 2017; Casey, 2018).

## Limitations

The scope of this research is focused on the modernization of Common Support Equipment, with no discussion of the modernization or acquisition of Automatic Test Sets. The acquisition process for current assets, or "new-old," is not considered. Rather than focus on how the enterprise procures replacement CSE, this thesis explores the procurement of "new-new" equipment. There is no discussion of equipment data collection or interpretation as other projects have already recommended increased data with current contracts in place to address that gap. Finally, this research has no intention of quantitatively proving CSE's importance to the Air Force mission.

# II. Literature Review

## Chapter Overview

This chapter shapes the context surrounding the operating environment of the support equipment management enterprise. To build the foundation of the modernization milieu, national and departmental policy will be summarized and discussed. The relevant governing regulations will also be outlined, providing the major actors' roles and responsibilities and specific relevant definitions. This chapter will conclude with a survey of AvSE research.

## National and Departmental Policy

The National Security Strategy (NSS) of the United States of America provides the strategic vision for the Executive Branch of government (Trump, 2017). Until the President publishes a new NSS, every branch's policy should subordinate to this vision, working towards a practical execution of the national priorities. Acknowledging the changing geopolitical landscape, the 2017 NSS describes the critical threat to American hegemony: the rise of China and Russia as peer adversaries. To meet these threats, the President named modernization his top priority for action by the Department of Defense (DoD).

Modernization efforts for the United States military should be undertaken with the goal of retaining overmatch: the ability to defeat any adversary in any situation (Trump, 2017). The military's advantages should be clearly understood by potential adversaries, with modernization focused on exploiting additional capabilities. Not to be singularly focused on hardware, the DoD is directed to eradicate administrative obstacles to

modernization—receptive to readily-available commercial technologies and practices. The NSS expects the DoD to rapidly test, benchmark, and deploy cutting edge capabilities.

The President named acquisition reform as the second military priority. Echoing the modernization directive, the NSS expects the DoD to reduce cost through innovative non-traditional technology sources (Trump, 2017). The policy directs a refreshed focus on maintenance and logistics, recognizing the vital role these functions play in the national ability to rapidly deploy with a resilient, agile force.

The National Defense Strategy (NDS), signed by the Secretary of Defense, provides DoD-specificity to the President's NSS. Published in 2018, Secretary Mattis' NDS acknowledges, "we cannot expect success fighting tomorrow's conflicts with yesterday's weapons or equipment" (Mattis, 2018). To rebuild the lethality of the American fighting force, key capabilities must be modernized.

The ability to employ forces in smaller pockets throughout the world, prioritized by the NSS, is reemphasized in detail. The NDS guides the military away from a traditional deployment of large, consolidated, uncontested infrastructure towards a dispersion of assets. Decentralization of assets necessitates the prioritization of mobility capability and prepositioned employment equipment. The NDS describes the force of the future as one with a light logistical footprint with fluid adaptation to an unrelenting, capable threat.

The current Chief of Staff of the Air Force, General Charles Brown Jr., published *Accelerate Change or Lose* in August 2020. He asserted the Air Force must adapt to new technologies and changing environments—challenging the status quo of current

operations (Brown, 2020). Action Order D of General Brown's directive calls for Airmen to "identify systems and programs that are outdated…to make way for capabilities that will make us competitive in the future high-end fight" (Brown, 2020). This directive is clear: the force must modernize.

The policy directives of both the NSS and the NDS prompted the Commanders of the Air Force's Major Commands (MAJCOMS) to codify the Air Force's modernization objectives (AMC/CD, et al., 2019). Paragraph 3, Item t. directs Air Force Materiel Command (AFMC), in conjunction with affiliated MAJCOMs, to "prototype, acquire and deploy experimental equipment," including Aerospace Ground Equipment (AGE) as a subset of CSE. In support of this effort, current AGE capabilities must be evaluated in both form and function to determine employment efficacy.

The modernization of CSE directly supports the Air Force's modernization priorities, the Secretary of Defense, and the President of the United States. Without parallel modernization efforts throughout the force, the United States military has no assurance of victory in a peer-level conflict.

**Governing Regulation**

The next subsection will summarize the governing regulation of CSE to provide the bounds of acquisition and procurement. AFI63-101/20-101 provides the backbone policies and procedures for acquiring all items intended to satisfy the warfighter's requirements (Department of the Air Force, 2020). Program Managers (PM) hold the ultimate responsibility for their respective acquisition programs and use AFI63-101/20-101 as their operating manual. To "provide efficiency and reduce cost," the AFI *prefers*

the employment of standardized support equipment or CSE. The PM should minimize the proliferation of equipment unique to a single system, subjected to that particular system's employment requirements.

Paragraph 7.17.1 specifically directs the PM to acquire, "to the greatest extent possible," support equipment that is common with other systems, service branches, and programs (Department of the Air Force, 2020). After careful consideration of all systems currently available in the Air Force inventory, if a PM determines that CSE assets do not meet the needs of a program, a waiver to acquire PSE is required. Waivers must be submitted to the Support Equipment Product Group.

If a PM is unable to satisfy the program's requirements through CSE, the Support Equipment Recommendations Data process through AFMC is initiated as the last alternative (Department of the Air Force, 2020). In summary, AFI63-101/20-101 provides clear, unequivocal guidance for Program Managers to maximize the use of CSE during the acquisition of any new program.

**Relevant Research**

Multiple studies have documented CSE's importance over the last 45 years (O'Donnell & Forster, 1975; Nauta & Ward, 1985; Williams, 1991; Leighton, 2017; Bobic, 2018; Casey, 2018). Each has examined a different aspect of the CSE enterprise, including acquisition, management, and employment. O'Donnell and Forster (1975), commissioned by the Logistics Management Institute, investigated AGE's acquisition process. The researchers employed a series of case studies to determine the current

acquisition process's ability to meet the needs of the warfighter through AGE procurement.

O'Donnell and Forster (1975) selected ten defense systems for analysis, with 76 specific items identified as case study subjects. From the case study subjects, 17 problems were classified with 20 causes. Though the authors determined that the acquisition process provided a sufficient system for acquiring support equipment, the process proved ineffective for complex electronic test.

Of the key recommendations, three are especially relevant to the current research topic. The first is the finding that the MIL-HDBK-300D, the central registry for support equipment employed by the DoD, was ruefully incomplete. Of the selected case study items, 73% were not included in the MIL-HDBK-300D, and 100% of observed electronic test equipment was not included (O'Donnell & Forster, 1975). The Air Force did not address the issue, and Chapter IV discusses how a lack of CSE documentation provides an obstacle to modernization.

O'Donnell & Forster (1975) also identified the Aerospace Ground Equipment Recommendations Data (AGERD) process, a precursor to the current Support Equipment Recommendations Data (SERD) process, as a reform candidate. The authors found that 20% of selected case studies did not use the AGERD, and governing policies did not effectively mandate the use of the process. Additionally, the authors observed that the average processing time for an AGERD was 200% of the allotted amount, providing further evidence for program reform. The lengthy, ineffective AGERD process transformed into the equally toothless SERD, and resulted in the current proliferation of PSE.

Finally, the study recommended creating a central governing body for the acquisition and management of support equipment. This office would facilitate communication between System Program Offices (SPO), store feedback data about purchased systems, and ensure the proper execution of a rigorous SERD process (O'Donnell & Forster, 1975). Though the authors recommended these changes 46 years ago, the same obstacles plague AvSE management today.

Nauta and Ward (1985), also commissioned by the Logistics Management Institute, focused on test equipment management policies. Though a slightly different resource than CSE, test equipment management overlaps significantly with CSE (Haralson, 2020). The study recommended changes to the Assistant Secretary of Defense for Manpower, Installations, and Logistics to address the low reliability, usability, and functionality of test equipment reported by end-users (Nauta & Ward, 1985).

The first change recommended by Nauta & Ward supported O'Donnell & Forster's 1975 recommendation for a revised central registry of all employed AvSE. The central registry would serve as a "DoD-wide preferred items list," providing a single reference point for PMs during the acquisition process and reducing the proliferation of unique items (Nauta & Ward, 1985). Additionally, the study recommends the standardization of test equipment data reporting, providing real-time capability and shortfall data. Finally, Nauta & Ward recommended a new instruction providing standardized guidance and administration of test equipment.

The authors concluded that many of the ongoing field-level employment challenges of test equipment could be mitigated by management changes. Many of the same recommendations from 1975 and 1985, including comprehensive documentation,

central management, data reporting, and written policy, are echoed by AvSE managers today.

An AFIT student, Bradie Williams (1991), examined the acquisition process of support equipment. He found that the Air Force has traded the necessary support equipment for additional airframes during major acquisition buys. As a result, while the larger fleet may be attractive on paper, the actual capability is much smaller due to a lack of required equipment. In other words, the Air Force shortsightedly eliminates expensive support equipment in favor of a few more aircraft, hamstringing maintenance efforts before the new weapon becomes operational.

Williams (1991) also concluded that the fluid political nature of acquisition management leads PM's to make decisions that are not in the best interest of the warfighter. The amount of money involved in the development and fielding of a new airframe is inherently political, leading acquisition professionals to take actions that run counter to their actual goals of producing lethal, cutting edge systems (Williams, 1991).

Compounding the unstable nature of the American political system's influence on the acquisition process, Williams points to Puckett's Law as another variability source (1991). Puckett's Law states that given the constants of cost, weight, and reliability, a system's capability can be expected to advance by a factor of two each year. During the complicated and lengthy process of weapon system design, the changing nature of the technology itself causes an endless possibility of updates and changes. Each time the technology mutates, support equipment redesign may be necessary. Often, this results in support equipment design late in the acquisition process, forced to "play a game of catch-

up and…never quite succeeding" (Williams, 1991). These updates are expensive, and the end product likely has not caught up with the final capabilities of the weapon system.

Furthermore, Williams' thesis identified the ever-increasing bureaucratic and cost processes as root causes of acquisition obstacles. He made the poignant prediction: "if the trend continues…by the year 2000…not a single weapon system [will be] procured. Total control results in total immobility" (Williams, 1991). He found that the support equipment acquisition process's failings are representative of the greater DoD system and often results in unreliable, late-to-need, incomplete, and wastefully expensive programs. He concluded by asserting that only expert adherence to the acquisition process could produce the desired end-state of fully-supported weapons systems.

Another AFIT student, Captain Michael Bayer (2003), conducted a study investigating the impact of AGE management concepts, quantity available, and aircraft numbers on a unit's ability to maximize sortie production. Conducted during the transition towards "right-sized" Air Expeditionary Force (AEF) Unit Type Code (UTC) packages, he validated a methodology for calculating the impact of AGE assets on a flightline.

The project utilized Scalable Integration Model for Objective Resource Capacity Evaluations (SIMFORCE) to simulate sortie production capabilities. Focused on seven pieces of CSE, Capt Bayer explored two methods of homestation AGE management—pooled centrally and allocated by unit. Central management resulted in a single pool of resources shared by the local flying units; allocated management dedicated specific pieces of equipment to each unit. By adjusting the number of aircraft deployed in his simulations, he quantified the impact of AGE resources available to each flying unit. He

concluded that the management style of AGE while operating under the AEF concept impacts sortie generation (Bayer, 2003). This paper, one of the first attempts to quantify the importance of AvSE on the Air Force mission, provided strong evidence that different management techniques produce different levels of mission generation.

Another research paper, written by Lieutenant Colonel Shane Barrett (2015), discussed the role of high-demand, low-density support equipment in contingency planning. His paper details the history of support equipment from the Wright Brothers in 1909 through the development of the F-35. Lt Col Barrett reviews the influence of the Cold War on the Air Force mission and structure, noting the careful planning of SE numbers and location. To ensure victory against an attack by the Soviet Union, the Air Force recognized the need for proper logistical support (Barrett, 2015).

However, the fall of the Soviet Union initiated a significant drawdown of the Air Force, both in size and budget (Barrett, 2015). The posture of support equipment resources was reduced significantly, no longer needed by the leaner fleet of active-duty aircraft. Since the cuts of the 1990s, the Air Force has developed a dependency upon contract logistics support (CLS) to provision SE for new airframe acquisitions. Subservient to CLS resources, legacy CSE does not benefit from modernization efforts, collapsing under the continued pressure to execute the mission. As a result, SE fleets are more specialized, less agile, and less available (Barrett, 2015).

To counter the decline of CSE, Lt Col Barrett argues that cuts to SE funding must be considered carefully. Higher priority must be given to SE sustainment, necessitating a paradigm shift by the planning community. SE availability is no longer guaranteed, and must not be treated by planners as a readily-available asset. His paper provides insight

into the changes to the Air Force mission since the dawn of military aviation, and outlines the recent problems caused by CSE funding cuts.

Capt Jason Leighton focused his AFIT thesis on the impact of CSE on Aircraft Availability (AA) (2017). He argued that the maintenance community struggles to adjust CSE authorizations or justify resource requirements due to a lack of quantifiable impact on AA. Recognizing the fleet's aging nature, coupled with reduced reliability, Capt Leighton blames the FY13 CSE funding deficit of $1.24 billion on the inability to draw a direct link between the equipment and AA (Leighton, 2017). Through a case study methodology observing six F-16 bases, the author examined two flying metrics, the flying schedule, and support equipment levels and authorizations, among other selected indicators.

After collecting the data, the author performed a quantitative analysis to determine the specific link between CSE and AA. Of note, the study initially focused on six pieces of equipment, three of which were AGE and three of which were Automatic Test Systems (ATS). However, due to a lack of availability of Integrated Maintenance Data System (IMDS) data, only the ATS items were studied: Environmental Control System Test Set (ECS Tester), Joint Services Electronic Combat Systems Tester (JSECT Tester), and TTU-205 Pressure-Temperature Tester (205 Tester).

During his data collection, Capt Leighton noted the difficulty he experienced gathering equipment data. The author used Precision Measurement Equipment Laboratory (PMEL) Automated Management System (PAMS) records to calculate the three selected pieces of test equipment's availability—a lengthy, labor-intensive process. The need for a consolidated equipment data system was a key finding of his study. The

results of his quantitative analysis failed to show any direct link between CSE and AA; however, his qualitative analysis presented strong evidence of a link.

During his interviews, respondents indicated a strong motivation to execute the flying mission, overcoming equipment shortfalls through methods not captured in the available data. As a result, the other key finding of Capt Leighton's study was that the maintenance community consistently overcame equipment shortfalls to execute the mission—inadvertently masking the true state of the equipment and its impact on the mission. Further obscuring the data, all six units pieced components together from unserviceable units to make serviceable sets (a practice known as Frankensteining) while carrying aircraft Partially Mission Capable (PMC). Because PMC aircraft do not impact a unit's AA rate, the study could not conclude that the three selected pieces of equipment directly impacted a unit's ability to execute the flying mission during FY16 (Leighton, 2017). However, through Capt Leighton's attempt to validate Capt Bayer's (2003) qualitative link between AvSE and mission capability, he highlighted the need for better data management and provided the foundation for another AFIT thesis.

MSgt Benjamin Bobic (2018) explored Capt Leighton's claim that maintenance culture obscured the true state of the AvSE fleet, coining the term "Flightline Heroics." Seeking to quantify the impact of Frankensteining, MSgt Bobic studied the impact on a technician's time and metric availability to recommend additional metrics for tracking. His research focused on the same three pieces of CSE ATS as Capt Leighton (JSECT, ECS, TTU205) and employed a case study methodology to explore technician impact (Bobic, 2018).

The author requested the six test bases submit spreadsheets documenting equipment sign-out, time-in-use, and corrective action times to collect data. Due to low participation rates, a small time-window, and minimal available data, the study could not quantify the impact of CSE on a technician's time. The study concluded with two recommendations: increased CSE metrics tracking and more proactive CSE management (Bobic, 2018). Though Bobic's methodology was unable to support a direct quantitative link between AvSE and mission generation, his work was the third attempt to validate the relationship.

**Summary**

This chapter opened with a summary of the current national and Air Force priorities, establishing the need to present a modern, flexible force to peer-level adversaries. Applicable Air Force Instructions then provided the policy directives urging the acquisition of common, cost-effective support equipment. Studies from 1975 and 1985 insisted the Air Force AvSE fleet was headed for failure, calling for comprehensive documentation, central management, data reporting, and written policy. Papers from 1991 and 2015 described an acquisition process that overlooks AvSE, leading to large fleets of aircraft struggling to meet their intended levels of readiness due to insufficient equipment. Three authors, in 2003, 2017 and 2018, attempted to quantitatively link AvSE health to mission generation, and provided some evidence for that link. The review of the AvSE research over the last 45 years highlighted both the vital role of Air Force support equipment and a consistent history of managers and researchers demanding reform.

# III. Methodology

## Chapter Overview

The purpose of this chapter is to discuss the methodology selected to analyze the obstacles to CSE modernization. The section will begin with a discussion of the research scope, followed by an introduction of the two texts used to guide the research design. The chapter then covers the processes of data collection and data analysis, and concludes by explaining the steps taken to ensure the validity and reliability of the data.

## Research Scope

The overview of CSE literature in Chapter II provided sources demonstrating the vital role CSE plays in the mission of the Air Force. Without reliable CSE in sufficient numbers, the process of aircraft regeneration grinds to a halt. This research builds upon that foundation which establishes the vital role of CSE, and seeks to enumerate specific obstacles to modernization in support of General Brown's Action Order D. Additionally, this research focuses on CSE modernization, without focusing on the routine AvSE management tasks. The obstacles explored by the research questions hinder efforts to modernize through the procurement of "new-new" CSE, as discussed in Chapter I.

## Methodology—A Qualitative Analysis

The methodological approach employed was primarily informed by two texts: *Research Design* by John Creswell and *Practical Research* by Paul Leedy and Jeanne Ellis Ormrod. Due to the complexity of the CSE modernization process, a qualitative approach was selected. With no previous attempts to model the problem and only a rough idea of the obstacles, a qualitative study best aligned with the texts' recommendations.

Comprised of many dimensions and layers, this study focuses on what needs to be explored by Air Force leaders to effect modernization.

To the greatest extent possible, the research was performed in the natural setting of CSE modernization, in the offices, conference calls, and visits to the organizations responsible (Creswell, 2014). However, due to COVID-19, most interviews had to be conducted over the phone. The researcher was the key instrument of data collection; questionnaires were not used (Creswell, 2014). Data were collected from as many sources as possible, including interviews, documents, training materials, and electronic presentations (Creswell, 2014; Leedy & Ormrod, 2015).

The constant comparative method was employed at all stages of the research process. This method, an iterative process moving between data collection and data analysis, allowed the researcher to refine and scope the inquiry through the course of the project (Leedy & Ormrod, 2015). An inductive and deductive data analysis process was employed, working back and forth through collected data to classify themes, determining if other data fit into those themes while identifying areas where more data collection were required (Creswell, 2014). Though this process cannot identify cause-and-effect relationships, the themes identified provide areas of focus to leaders desiring change (Leedy & Ormrod, 2015).

Finally, a qualitative study was chosen to take advantage of three strengths identified by Leedy & Ormrod: multifaced description, verification, and problem identification (2015). Through a multifaced description, the complex nature of CSE modernization was explored. Verification was used to test the validity of the sponsor's claim that significant obstacles impede modernization. Finally, through the process of

problem identification, this work intends to inform Air Force leadership about the changes required to modernize one of the Service's most important assets.

After selecting a qualitative approach, a grounded theory research design best met the needs of the research questions. The grounded theory approach starts with the data available and builds a theory based on that data (Leedy & Ormrod, 2015). In this case, large amounts of data were available, and no other research had formed a theory about CSE modernization obstacles.

Due to the flexibility offered by the grounded theory approach, techniques were borrowed from the ethnography and phenomenological study methodologies. Ethnographies study entire groups, including their cultures, interactions, beliefs, and processes (Leedy & Ormrod, 2015). This study was focused on the interactions between members of the organizations responsible for modernization, though not culturally or anthropologically. Because modernization requires repeated interactions between different organizations, key informants, and participant observation provided insight into modernization processes. Participant observation allowed the researcher to witness recurring meetings and interactions, while key informants within the community provided clarification and context to the observations (Leedy & Ormrod, 2015).

Phenomenological study techniques were also utilized—observing people's perceptions of a situation. Seeking to understand how people feel about modernization, mostly unstructured, lengthy interviews utilized a few, carefully selected set of participants, all with direct experience of the modernization process and its sophistication (Leedy & Ormrod, 2015). Participants were selected based on the recommendations of the sponsor, and triangulated with the recommendations of two other key informants.

Most organizations included interviews with both military leadership and civilian managers.

Based on grounded theory development and augmented by techniques from ethnographical and phenomenological approaches, the constant comparative method was applied to build a compelling picture of the obstacles faced by those responsible for CSE modernization in the Air Force.

**Data Collection**

The primary method of data collection employed was the use of interviews and informed by the aforementioned texts. Each interview started with the same three questions, with the rest of the conversation mostly unstructured.

Experts were selected based on current or recent experience with CSE modernization, including headquarters policy and management, finance, acquisition, lifecycle management, research, and employment, as well as one member of the Air National Guard. During this thesis, the names of the individuals interviewed will not be disclosed. Certain documents will be credited to their authors, with prior permission. Most data were kept confidential to minimize the risk of reprisal and encourage transparency.

As necessitated by the approach described in Leedy and Ormrod (2015), the data collection of documents, presentations, slides, and training materials all contain the perspectives of the members of the group. Additionally, only data that was accurate and consistent with the research questions were included, ensuring validity. All data were evaluated for consistency with the patterns revealed to maintain reliability.

Triangulation was also employed to validate the consistency and credibility of data (Leedy & Ormrod, 2015). This approach collects multiple forms of data from multiple sources. The data were also collected over a 1-year period, from January of 2020 through January of 2021, and included multiple visits, trips, phone conversations, emails, and observations. A discriminant sampling of SMEs built a thorough picture of the obstacles to modernization (Leedy & Ormrod, 2015). Due to the presence of a power hierarchy, samples of data were taken from multiple points within the organization (Leedy & Ormrod, 2015). By sampling diverse contexts and situations, triangulation was utilized to validate the consistency and credibility of observations and interview findings. Finally, consensus was sought by providing the study results to the sponsor before completion for clarification and review.

The use of a rigorous process of long-term, consistent data collection, utilizing established techniques developed by leading research-design experts ensured the validity and the reliability of the data collection process.

**Data Analysis**

The data analysis process was also informed by the two Creswell, Leedy, and Ormrod texts, primarily executed through the constant comparative method. Additionally, Creswell's data analysis spiral was utilized in an iterative process. The spiral starts with (1) the organization of data, followed by (2) a review of the data for pattern identification and exploration, then the (3) identification of themes and categories in the data, concluding with (4) the summarization of the interpretation of the data (Leedy & Ormrod, 2015).

After an interview was completed, the conversation notes were transcribed into a document and then coded based on patterns in the responses. The responses were then categorized by subject and organized by topic. After five interviews, a start list of categories was used, with five themes selected as critical obstacles to modernization (Leedy & Ormrod, 2015). As patterns in the coded responses were identified, they pointed towards a natural progression of events, further clarifying the obstacles (Leedy & Ormrod, 2015). Outliers, exceptions, and contradictions were also noted. Finally, the coded data were converted into cycles of obstacles and interpreted through flowcharts (Leedy & Ormrod, 2015).

As with any qualitative study, the author considered the potential biases he brought to the analysis. As an Air Force officer, some of the interview responses may have been affected due to a perceived rank or power gap. To overcome this barrier, before each interview, the academic nature of the research was clarified and the respondent was assured of complete confidentiality.

Another potential bias stemmed from the author's primary professional experience as an Aircraft Maintenance Officer. Reflexivity, a researcher's influence on the outcome of a study due to background, must be addressed to ensure the validity and reliability of the findings (Creswell, 2014). Experience with CSE on the flightline, backshop, and deployed all formed a context that had to be considered. To overcome this potential bias, only the words and ideas of the interviewees were used as data sources.

Finally, the research sponsor also provided a source of bias. As a significant data source, the sponsor coordinated many of the initial interviews and is highly motivated to uncover and address obstacles to the modernization process. To address this bias, the

sponsor's data was triangulated with other data sources to ensure validity and reliability (Leedy & Ormrod, 2015).

## Summary

This chapter discussed the scope of the research, focusing on the obstacles to CSE modernization and relying on the work of other scholars to establish the gravity of the need to maintain a reliable fleet. The chapter also discussed the chosen qualitative methodology, primarily informed by two texts by Creswell, Leedy, and Ormrod. Employing techniques from grounded theory studies, data validity and reliability were ensured through triangulation and the constant comparative method. Finally, the data was coded and organized by theme, and analyzed with the potential biases of the author and sponsor in mind.

# IV. Analysis and Results

## Chapter Overview

The previous chapters established the urgent need for the Air Force to modernize the current CSE fleet, detailing examples of waste, reviewing national and Air Force policy, and summarizing significant CSE works over the last 45 years. Chapter III explained the methodological rigor applied to this research, and Chapter IV will provide the analysis of those results. This chapter is organized into three sections, one for each research question. As discussed in Chapter III, these results are the expressed opinions of interviewed Subject Matter Experts, and names have been withheld to protect the integrity of the work and their responses.

## Analysis and Results

RQ 1: What are the top five obstacles to Common Support Equipment modernization?

The five themes that SME's expressed as obstacles to CSE modernization were Inadequate Resources, Administrative Structure, Acquisition Management, Communication Breakdowns, and Competing Cultures. The five obstacles identified by the interviewed experts each contribute to failed efforts to modernize.

### *Inadequate Resources*

The first obstacle to CSE modernization identified through the data collection process was a lack of resources; both funding and manpower. The current state of CSE sustainment, or the management and purchase of "new-old" equipment, is dire. Managers responsible for the life cycle management of the support equipment fleet estimate a $2 billion disconnect between current funding and sustainment needs. Triad members

estimate $150 million is needed annually to prevent on-hand assets from critically degrading below 75% of authorization levels. To bring current assets back to approved authorizations, $250 million to $300 million would be needed annually for the next 15 years.

To understand the context and current state of neglect, an overview of AvSE funding history is necessary. Before 2004, all sustainment of AvSE was funded through investment funds 3010 BP12 and 3080 BP84 and was highly centralized as part of the cumbersome Future Year Defense Program (FYDP) process. The funding process was slow and inflexible due to significant documentation and justification required by the Corporate Structure. In a move to accelerate the AvSE acquisition process and better align purchases with warfighter needs, the Vice Chief of Staff of the Air Force directed a complete program overhaul.

Significant change took place in 2004, during the Air Force mission-pivot from near-peer adversaries to counter-insurgency warfare. Congress approved an investment budget threshold increase to $250 thousand, recategorizing 96% of the AvSE portfolio to Operations & Maintenance (O&M) funding. This transfer, referred to as the Support Equipment Transformation (SET), fundamentally altered AvSE funding and management and produced second and third-order effects that the managers of the day did not expect.

The equipment below the $250 thousand threshold was no longer managed centrally, but placed the sustainment responsibility with the individual MAJCOMs. The new process would empower MAJCOMs to prioritize AvSE needs, assuming responsibility for all planning, programming, and budgeting. This change was intended to

streamline the budgeting process, provide flexibility during the year of execution, and reduce the time to procure new equipment.

SET managers recognized the importance of retaining commonality, interoperability, and standardization through centralized procurement, consolidation of purchases, and economies of scale. However, the practical management of AvSE, including its procurement, would remain under the Air Logistics Centers (ALC), members of AFMC. Longer-term contracts would be managed by the ALCs and funded by the MAJCOMs, based on the MAJCOM's priorities. For example, an upgrade to an F-15E AvSE item would require Air Combat Command (ACC) to coordinate with AFMC and use ACC funds. This new process reduced the funding burden, but increased the communication required to coordinate priorities and funding.

SET clarified management responsibilities for Peculiar Support Equipment (PSE), giving individual MAJCOMs the ability to move unilaterally to implement equipment changes. However, SET obscured CSE management lines, leaving multiple organizations responsible for sustainment, with no clear funding source.

Between 2004 and 2007, the expensive Global War on Terror forced the Air Force to choose which programs would be underfunded. Unclear lines of responsibility for AvSE were clarified through Centralized Asset Management (CAM) in 2007, re-establishing a central authority to make changes to CSE with a unit cost of less than $250 thousand. Reverting to vertical management of CSE, CAM was intended to streamline budget programming and allocation processes that the MAJCOMs had operated for the previous three years. However, by lumping all AvSE back under one organization, the standup of CAM caused budgeting for specific CSE items to lapse because funding lines

for individual items were lumped together under an organization without a significant annual budget.

AFMC was established as the lead MAJCOM for CSE, but without access to O&M funds, could not make large financial commitments without first enlisting support from other MAJCOMs. One-year O&M funds, primarily at the disposal of the MAJCOMs, were too unpredictable to provide the necessary forecasting and strategy for CSE. To make matters more complicated, a change to a CSE asset required coordination between multiple MAJCOMs, without AFMC managers possessing any lead command authority.

Access to funding was not wholly cut off, however. AFMC could advocate for investment funding through the Pentagon's Air Force Logistics (Log) Panel. Responsible for multiple logistics priorities, the Log Panel has not frequently prioritized AvSE modernization, as AvSE makes up only 6% of the entire logistics portfolio.

The Log Panel's long list of competing priorities to AFMC's CAM portfolio made it easy to divert money away from CSE management, and resulted in a significant annual funding decline from 2007 until 2016. The remaining budget, unable to cover the necessary replacement of fielded items, led to multiple partial programs, gaps in on-hand asset levels versus authorizations, and threatened the Air Force's ability to meet published OPLAN requirements. Critical CSE assets, including flightline generators and munitions loaders, currently have on-hand levels below the 75% authorization line.

As a result of enterprise CSE managers' growing concerns, the Air Force changed CSE funding back to investment dollars in 2016. However, asset levels are so critical that operational units must maintain exhausted equipment for cannibalization of parts. Unit

possession of these dilapidated assets paints an inaccurate picture of the health of the CSE fleet, allowing funding to go to other priorities due to a lack of data.

The twelve-year period without investment dollars has resulted in a CSE fleet that cannot be fixed in a single year of FYDP planning, but must be treated as a long-term priority. Current managers, responsible for the sustainment and purchase of "new-old" assets, must make tough decisions, funding only a small number of the highest priority projects each year. Without the necessary funds to fill existing CSE backorders, AFMC managers had no funding remaining for modernization efforts.

To pursue CSE modernization projects, AFMC requires access to 3600 investment funds. AFPAM63-128, the policy governing life cycle management, allows the modernization of a system through investment funds: "Modifications can occur throughout the life of a system. …changes made to maintain the existing capability are funded via the O&M appropriation while changes made to improve or upgrade the system are funded with investment appropriations" (Department of the Air Force, 2014).

Until FY18, dedicated CSE investment funding was nonexistent. Current procedure forces AFMC modernization projects to compete with other priorities through the Air Force Corporate Structure. The SET and CAM policies have decimated the CSE budget, requiring all available financial resources to be dedicated to sustaining a depleted fleet.

The second resource preventing CSE modernization is manpower. The three management triad members, discussed in Chapter I, are not adequately manned to manage CSE through the product lifecycle. Presently, modernization is not an automated process. Each of the 53,000 unique stock numbers is managed by a small team of people,

with little to no augmentation by automated processes. Any modernization initiative requires manpower to study existing capability, justify recommended changes, inform the acquisition process, and manage initial fielding. While the 635 SCOW manages the basic redistribution of assets based on asset levels and vacancies, it does not track fleet health. Unable to manage both "new-old" and "new-new" projects with current manning levels, CSE triad organizations spend their time addressing only the most urgent priorities.

Inadequate resources, the first obstacle to CSE modernization, have resulted in a poorly sustained fleet of equipment. Both SET and CAM, policy initiatives designed to streamline funding and management of SE, have been inadequate vehicles for effective sustainment of CSE. As a result of low-priority budget allocations over fifteen years, the CSE management triad is tasked with preventing mission failure with an expended fleet of equipment from the 1960s and 70s. Without the manpower resources to manage both the current fleet and plan for the fleet of the future, CSE modernization projects are often dead-on-arrival.

*Administrative Structure*

The second obstacle to modernization identified through SME interviews is the current administrative structure of CSE assets, and broken into three themes: a lack of strategic vision and authority, enterprise management of AvSE, and data management. Each of the three themes points to a different aspect of modernization failure in the management structure.

When SET assigned PSE to individual SPOs, and CAM consolidated CSE under AFMC, AvSE was left with no unifying, strategic vision or authority. In practice, each office followed a different process for modernization. The SPOs focused only on their

assigned weapon system, initiatives like AFWERX and Spark Tank focused on grassroots projects, and no organization had a formal process or authority to coordinate these efforts. Even the definition of "modernization" is not consistent, with no sole policy governing the CSE portfolio. Though AFMC is the designated lead MAJCOM for CSE, no Executive Agent has been designated as a full-spectrum Program Office (PO) with the commensurate authority.

This authority vacuum enables outsized individual MAJCOM influence on the modernization process. Because AFMC does not control the purse strings, other MAJCOMs do not necessarily follow lead command policy, as their readiness is based on their operations requirements, outlined in documents like AFI10-201 and AFI10-601, subject to AFPD10-9. Chapter II discussed the SERD process and highlighted the process's lack of authority to force the unification of modernization efforts. Thus, without fiscal or managerial authority, AFMC must integrate the requirements of eight other MAJCOMs when tackling a CSE modernization project. Even when a project is in the enterprise's best interest, a single MAJCOM can hijack the process, blocking the linkage of requirements and condemning the project to failure.

The second theme pointing to the current administrative structure as an obstacle to CSE modernization is a lack of enterprise-level management of AvSE. A result of SET, multiple links exist between the Pentagon and organizations responsible for AvSE management. SPOs, under the influence of their lead MAJCOM, often modernize the PSE assigned to their programs, but that money is spent in silos, with no consideration of similar projects in the enterprise. The SERD process requires a cursory look at existing CSE but merely recommends consolidation and does not include a requirement to

consider existing PSE. Each SPO develops specifications based only on their own requirements with no analysis of further applicability. No one asks, “If we spend 10% more, could this be useful on another platform?” Triad members are often not included in ongoing PSE modernization projects and have no vehicle to leverage procedural change to benefit the larger fleet. Finally, because the triad works for AFMC/A4, they are often unaware of the larger acquisition picture available to SAF/AQ, leaving the very organizations responsible for CSE modernization out of the development process.

This lack of coordination results in an ambiguous process, short-circuiting fresh thought, and producing ambiguous requirements. AFMC estimates that a minimum of 50 to 100 duplicative pieces of equipment are currently fielded because SPOs do not usually coordinate modernization projects or requirements.

The third theme to emerge as a result of a faulty administrative structure was data management. Chapter II cited multiple studies that called for improved AvSE data management, but primary documents like the MIL-HDBK-300 have since been discontinued. The old system designed to manage AvSE data, the Air Force Equipment Management System (AFEMS) was not audit-ready, and the new subsystem in the Defense Priorities & Allocation System (DPAS) designed to track the data, the Maintenance and Utilization module, is not yet operational. As a result, no hard data exists to support modernization. Without health and usage data, or the necessary records to prove the impact of AvSE on either readiness or AA, no definitive link can be drawn between failing equipment and mission execution.

Finally, the lack of adequate central data management has resulted in a significant loss of minimum requirements documentation. The SERD is one of the documents

containing minimum system requirements during a system's acquisition, but no central body has retained these documents. Often no requirements documentation exists in the SPOs, and all requirements are maintained and furnished by the original contractor. Managers of modernization projects are then forced to perform the arduous task of retrieving requirements from original contractors, if the companies still exist. The current management structure does not retain basic data to track existing stock numbers, daily equipment utilization, or the original requirements and design specifications. Without original minimum specifications, design functions, and requirements of the legacy system, and all modifications and upgrades, modernization projects will not succeed.

*Acquisition Management*

The two themes managers identified supporting acquisition management as the third obstacle to CSE modernization were the misalignment of incentives and existing current policies and practices.

AvSE is part of every major weapon system acquisition (Williams, 1991). These programs take years to develop and run concurrently, making it difficult to find a one-size-fits-all, CSE solution. The advanced weapons developed today require support capabilities not available in the current AvSE portfolio, as the defense contractors are keenly aware. Because modern capabilities take years to develop, by the time a weapon system is ready for AvSE, the Air Force is years behind in the process and has nothing new to offer.

Support Equipment provides a lucrative opportunity for a defense contractor, who has no incentive to develop equipment compatible with multiple weapons systems. The current policies in place require a contractor to consider existing CSE, but allow the

company to outsmart the system, designing tolerances tight enough to preclude the use of CSE. Because it takes a significant amount of time to prove that published requirements are unnecessarily restrictive and benefit the contractor, most PO's will not delay the acquisition of a new airframe by requiring redesign to accommodate existing CSE. As a result, every new airframe acquisition exacerbates the proliferation of PSE, procuring highly specialized pieces of equipment to perform tasks relatively common to other airframes.

Financial incentives also counter CSE modernization efforts. Because the expense of restarting a production line typically precludes the Air Force from purchasing discontinued airframes like the F-22, the Service is strongly incentivized to prioritize the initial airframe purchase. If allowed to choose, the Air Force has historically prioritized dedicating allocated funds to additional aircraft over the necessary equipment to operate those aircraft. The lack of data, discussed as part of the administrative structure obstacle, exacerbates this issue. AvSE acquisition is then deferred to a later point.

The Air Force is also strongly incentivized to progress an airframe through Operational Test and Evaluation (OT&E), Initial Operating Capability (IOC), and Full Operational Capability (FOC). AvSE acquisition timelines do not naturally coincide with airframe timelines, though each stage relies upon AvSE for success. OT&E usually results in an early need for AvSE, as testing requirements take time to meet. Because AvSE takes time to develop, and the Air Force has not prioritized organic modernization, contractors are enabled to provide expensive PSE solutions. This forces the Air Force into expensive, commercial off-the-shelf (COTS) or peculiar equipment that benefits the contractors but keeps the larger program on track.

The second theme, program management policies and procedures, also provide obstacles to CSE modernization. Program Offices follow 63-series AFIs, which are very narrow in scope and focus. In turn, they are directed by 10-series AFI requirements, providing clear directives through a single lead command. These acquisition programs are not subject to any common directives that would require consideration of CSE to benefit the larger enterprise.

Additionally, program offices are not held responsible for their airframes' requirements and rely heavily on AFMC for information specific to their programs. SME's asserted that the program offices were heavily reliant on contractors for basic system requirements in multiple interviews. If program offices cannot provide system requirements, the coordination necessary to accomplish a CSE modernization project across multiple airframes faces a significant obstacle.

Finally, "rapid acquisition" policies have not been applied to all of the necessary organizations to enable the synchronization required to modernize CSE. Without the ability to bypass current regulations, CSE triad managers fall further behind accelerated programs.

In summary, two aspects of acquisition management provide significant obstacles to CSE modernization. Defense contractors are incentivized to shoehorn the Air Force into expensive PSE decisions. Misaligned incentives prioritize purchasing additional aircraft over the AvSE required to execute the mission. High visibility weapons systems programs prioritize the program's timeline over the opportunity to modernize and consolidate AvSE. No central policy exists to enforce principles of commonality and interoperability through CSE. Furthermore, written policy does not require program

offices to maintain system requirements, forcing dependence on AFMC and defense contractors. As a result of these incentives and policies, the Air Force has an ever-increasing amount of expensive PSE and failed CSE modernization projects.

*Communication Breakdowns*

The fourth obstacle to CSE modernization, communication breakdowns, initially appeared to be a result of the current management structure, but highlights more pervasive failures across the enterprise. Multiple interviewees discussed examples of communication breakdown, even when the avenues of standardized communication were firmly established. For example, the Air Force recently hired a contractor to establish sustainment priorities for an airframe's AvSE. Using survey research, the contractor determined which pieces of AvSE most urgently required replacement or upgrade. This contract is a symptom of a communication breakdown between end-users and those responsible for AvSE sustainment. Air Force organizations should not be reliant upon an outside contractor to mediate the communication of priorities and requirements.

Additionally, though the Log Panel has multiple competing priorities, an avenue of modernization funding has always existed for AvSE. For over fifteen years, CSE managers have been told that their modernization needs are not critical enough to warrant the Log Panel's attention. Poor communication has resulted in an inaccurate Corporate Structure perception of the actual state of CSE. Interviewees described a disconnect between the critical nature of AvSE in the chain-of-supportability of mission-generation, and Corporate Structure consideration of CSE priorities. Without effective communication, the Corporate Structure assumes adequate levels of AvSE and directs funding to more urgent priorities.

Finally, minimal communication occurs between the innovative branches of the Air Force. Organizations like AFWERX, Spark Tank, the Agile Battle Lab (ABL), the Air Guard/Air Reserve Test Center (AATC), and AvSE triad members have rarely communicated about ongoing projects. Without coordination of requirements and triad involvement, even the most promising modernization initiatives will not succeed.

Communication breakdowns across the enterprise have precluded the success of critical modernization projects. The breakdown of established communication channels, inaccurate Corporate Structure perception, and an inability for innovation organizations to work together has resulted in the CSE fleet's current state.

*Competing Cultures*

Finally, three aspects of Air Force competing cultures reinforce the fifth significant obstacle to CSE modernization. Interviewees pointed to tribalism, end-user values, and inter-organizational distrust as cultural breakdowns.

Members of AvSE management organizations share a common perception that tribalism affects almost every modernization initiative. Interviewees described tribalism as the prioritization of unit goals at the expense of the priorities of other units or the larger organization. Impacting data integrity, resource allocation, and resistance to change, tribalism prevents organizations from sharing capability. One example cited resistance to automation because of the effect it would have on AGE manning positions. Other managers expressed frustration that modernization efforts are frequently obstructed because the disruption to the status quo may empower the end-user and threaten the job security of supporting roles at the SPO.

Wing-level, end-user culture also provides obstacles to CSE modernization. Dedicated to the success of the daily flying schedule, Wing exercise, or Air Tasking Order, maintenance units possess an unmatched capability to employ assigned resources to execute the mission. The Aircraft Maintenance community lives by a "no-fail" credence, determined to regenerate aircraft against all odds. Defective AvSE is cannibalized, temporarily repaired, Frankensteined together, or replaced with COTS solutions using Wing O&M funds.

However, this patriotic dedication produces an obstacle to CSE modernization. Wing exercises, intended to highlight areas of weakness, become drills in "simulated" equipment, leading to the assumption that required resources are available to execute the mission. When a unit "simulates" the use of equipment that would not be available in a wartime scenario, the sorties produced during the exercise are not a true picture of capability. As a result, capability gaps are not highlighted because leaders are unwilling to let their organizations fail due to equipment. When the mission never fails because of equipment, the Corporate Structure does not understand the link between AvSE and the mission. In times of war, American patriotic dedication overcomes incredible odds, but during peacetime exercises and training missions, obscuring the state of CSE threatens future success.

Finally, inter-organizational distrust reinforces cultural obstacles to CSE modernization. Each of the primary management organizations responsible for AvSE expressed a perception that top Air Force leaders would rather trust grassroots efforts over the expertise of those tasked to modernize. But without expert guidance, grassroots efforts usually result in solutions focused on a single problem. Therefore, funds are

dedicated to AFWERX and Spark Tank ideas with minimal consideration of the larger picture.

In summary, critical aspects of Air Force culture create obstacles to CSE modernization. Tribalism intended to protect job security undermines effective communication and trust, “Flightline Heroics” obscure the true nature of their organization’s capability, and organizations focused on grassroots innovation efforts are considered more trustworthy than triad members.

Obstacle Cycles

The five obstacles identified by the interviewed experts work in cycles to thwart even the most well-articulated and justified modernization efforts. It is necessary to note, not all modernization fails are necessarily wrong. In some cases, the different organizations provide much-needed checks and balances to counteract stove-piped thinking. However, this study focuses on the obstacles to genuine modernization requirements.

Figures 1-3 provide typical examples of modernization obstacles but do not map the modernization process completely. They should be interpreted as examples rather than the definitive root causes of every CSE modernization project failure.

Figure 1 provides a visual flowchart of the actions a field unit must take after identifying a CSE modernization need. Dashed boxes illustrate a transfer of organizational responsibility for a CSE modernization project. Failed modernization efforts, illustrated by the dotted boxes, contain one or more of the five obstacles identified during this research.

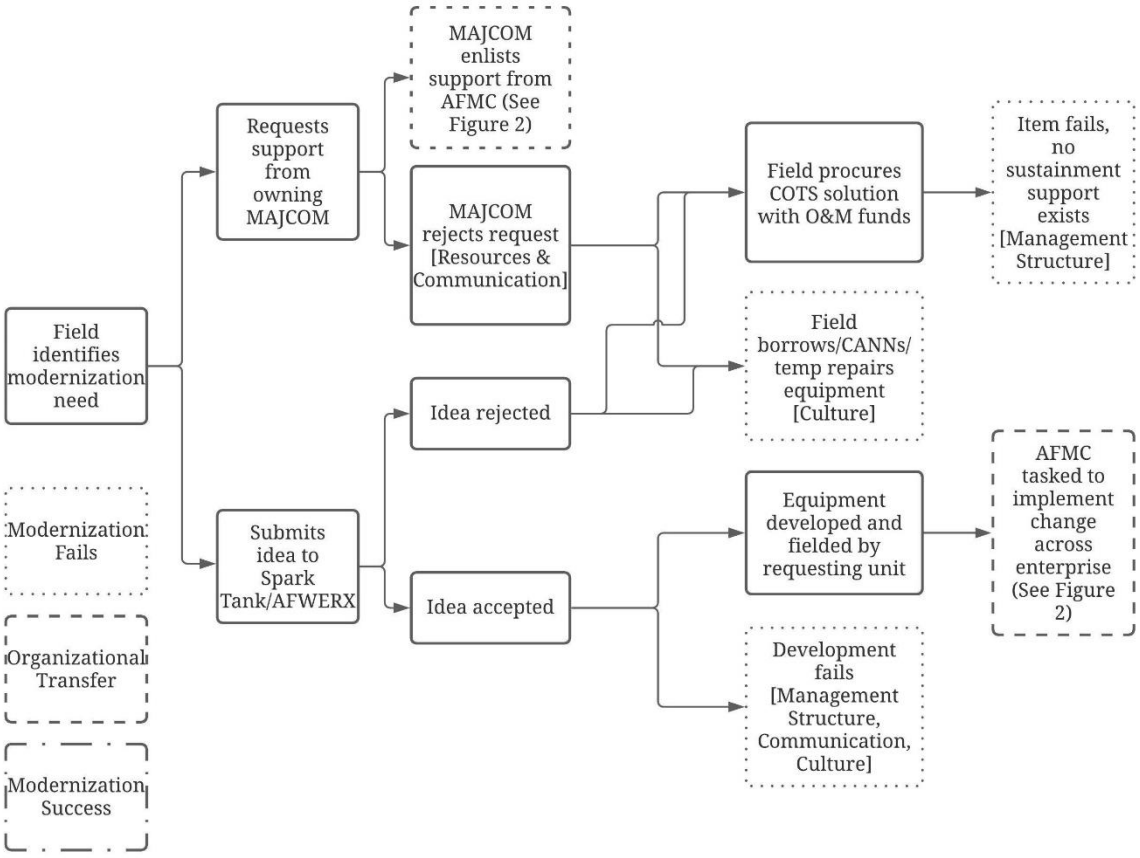


Figure 1: Field Level Modernization

Both the WST at the owning MAJCOM and innovation cells provide modernization avenues to the field, but neither can affect CSE change without assistance from AFMC. AFMC plays the central role in every CSE modernization project. If a genuine modernization requirement does not succeed for any reason, the field is driven to circumvent the process with local solutions. Because the field-level units are highly motivated to prevent mission failure, rejection or dismissal of a genuine CSE modernization need will result in the unit procuring COTS equipment, further exacerbating the problem and obscuring the actual state of CSE.

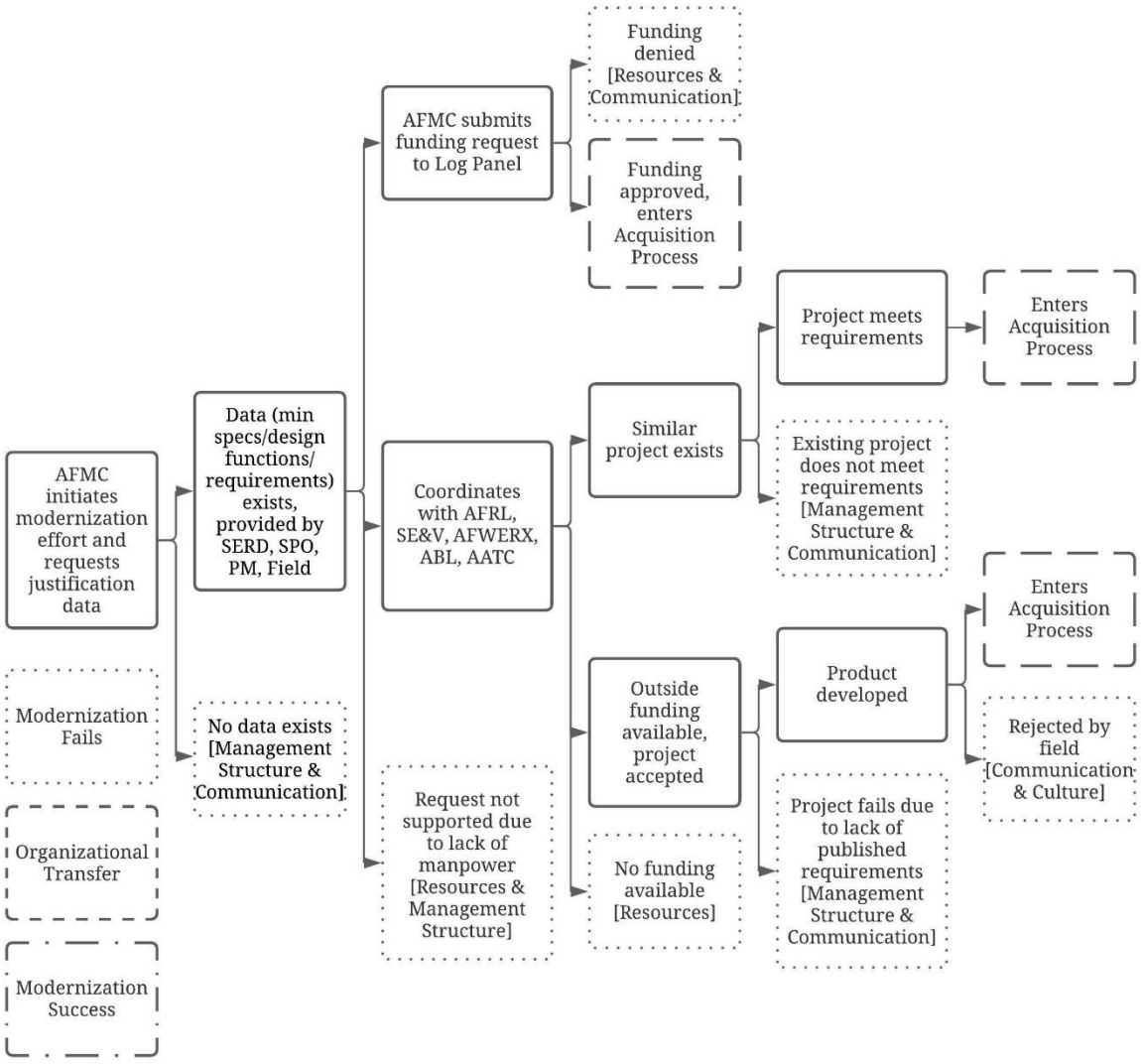


Figure 2: AFMC Modernization Actions

The above figure, AFMC Modernization Actions, provides an approximation of the actions available to triad organizations to execute a modernization project. The coordination required to modernize a CSE asset is considerable, and each step may be impeded by one of the five obstacles identified by interviewees. This process is characterized by AFMC, the organization primarily tasked with the sustainment of CSE, faced with inadequate authority, policy, and resources to achieve change successfully. In

the unlikely chance AFMC's coordination efforts are successful, the modernization project enters the Acquisition Process in Figure 3.

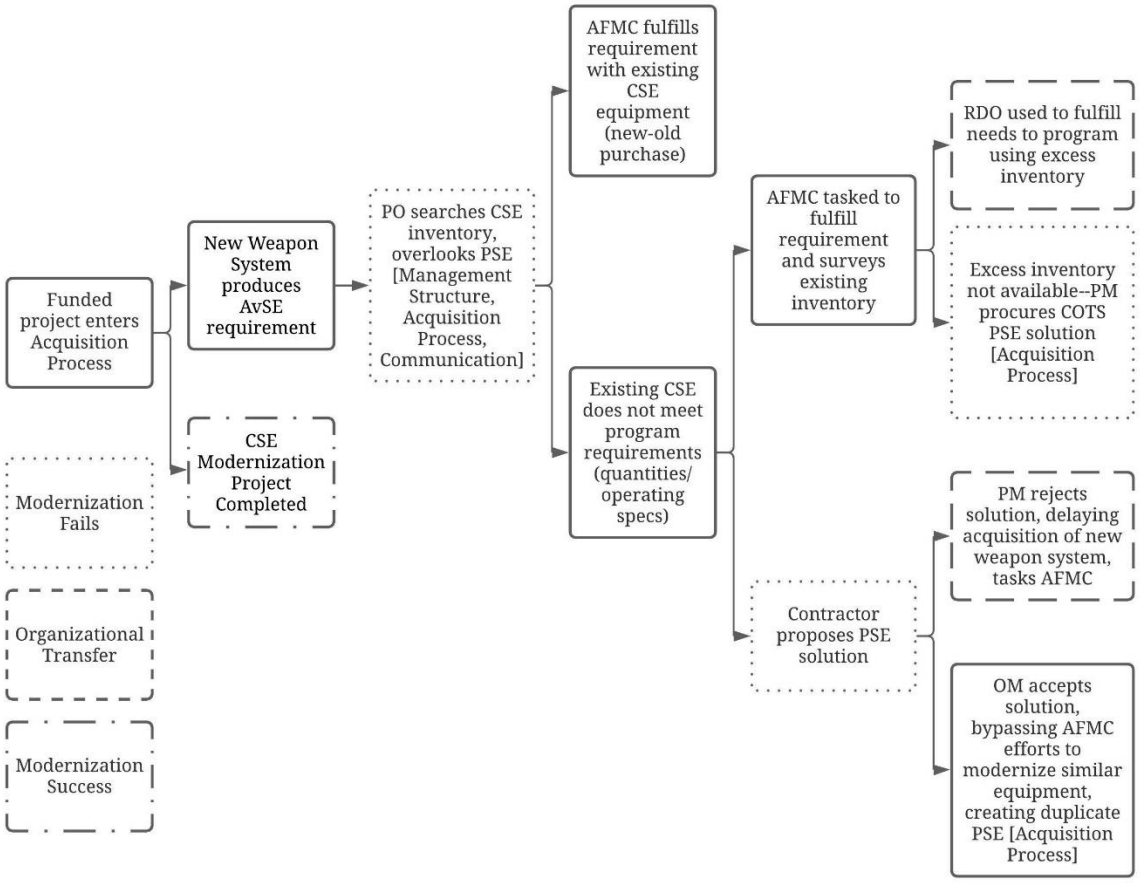


Figure 3: Acquisition Process

The approximation of the acquisition process in Figure 3 is intended to highlight two findings. The first is that a successful CSE modernization project requires significant coordination by AFMC before the process even begins. The second finding is illustrated by the upper branch of the decision tree. In this branch, the Air Force initiates the development and purchase of a new airframe or weapon system. AvSE, a critical link in the Integrated Product Support (IPS) Elements for logistics support, must be included with the purchase. However, current acquisition policy and practice overlooks PSE

resources in the current inventory, and enables the contractor to force the Air Force into no-win decisions. In most recent cases, the Air Force had to choose between delaying a major acquisition program and purchasing expensive, duplicative pieces of PSE.

The above figures illustrate two key findings of this study: modernization projects face more obstacles than paths to success, and AFMC is central to every successful project. Without significant coordination, the identification of a modernization need by the field usually leads to PSE proliferation or "Flightline Heroics."

The interviews, documents, and reports collected to answer Research Question 1 were categorized into five categories: Inadequate Resources, Administrative Structure, Acquisition Management, Communication Breakdowns, and Competing Cultures. Each obstacle compounds upon the others to render most CSE modernization efforts as failures. These obstacles are usually not a result of a poor work ethic or laziness, but emerge from each organization's different policies, incentives, and cultures. The data collection process uncovered hard-working, patriotic Americans who were frustrated by obstacles and forced into repetitive cycles that usually resulted in failure to modernize.

RQ 2: What are the consequences to the Air Force mission and objectives due to those obstacles?

After identifying the five obstacles to CSE modernization, interviewees were asked to discuss the probable consequences of a failure to modernize. The responses were categorized into three themes: Agility, Financial Waste, and Mission Surety. These themes provide examples of the consequences of the identified obstacles. This thesis does

not attempt to adjudicate each situation, but provides patterns of the consequences of modernization failures.

*Agility*

The first consequence of failed CSE modernization is degraded Air Force agility. As the Global War on Terror has drawn to a close, the NSS and NDS have refocused the DoD on preparing for conflict with peer-level adversaries. Unlike the dominance the Air Force has enjoyed since the end of the Cold War, technologically advanced adversaries will not allow the use of superbases, quickly disrupting our predictable supply chains and logistics tails. As American rivals grow in power, the Air Force must adopt a lighter footprint. Agile Combat Employment (ACE), the Air Force response to the call for agility, demands a large reserve of reliable, flexible prepositioned equipment. Every AvSE manager interviewed asserted that the current fleet of CSE is insufficient for this type of warfare. Three former MAJCOM-level planners cited AvSE as the biggest impediment to large-scale warfare, because of the amount of airlift required to deploy the required equipment.

Equipment footprints and airlift requirements provide the biggest impediment to adaptive basing concepts. The Service's newest fighter, the F-35, is supported almost exclusively with PSE. This means a small forward-deployed contingent of F-22s, F-15Es, and F-35s would each require significant airlift, supported by duplicative equipment items without any interoperability. The current, highly-specialized AvSE footprints preclude any practical ability for fighter fleets to operate in true expeditionary nature.

*Financial Waste*

The second consequence of a failure to modernize CSE is significant financial waste. The annual nature of O&M funds forces Program Offices to participate in expensive catch-up projects during airframe modifications and other targets of opportunity. Long-term funds have not been available to provide predictable, stable planning in order to clarify requirements and reduce cost. In many cited cases, modernization projects used money earmarked for other essential purposes, diluting both projects' effectiveness.

The five obstacles to CSE modernization also produce a proliferation of PSE and duplicative equipment items. Subject matter experts described examples of equipment that perform identical tasks but only interface with a specific aircraft. Another example cited duplication of indoor and outdoor equipment, forcing the enterprise to sustain two unique products because of a lack of coordination during these items' procurement. In a final example of financial waste, Air Force Research Laboratory (AFRL) resources were dedicated to testing power pull requirements on legacy airframes because the basic system requirements data no longer existed. Catch-up contracts, duplicative equipment, and missing requirements data provide three examples of financial waste as a result of the five modernization obstacles.

*Mission Surety*

The final theme identified as a consequence of failed CSE modernization is mission surety, defined by this thesis as "the confidence of mission success." AvSE managers understand the cybersecurity vulnerabilities inherent to outdated equipment

operating in a modern environment. Without proper research and coordination, CSE may be exploited by an adversary.

Even more troubling, AvSE managers feel that key Air Force decision-makers likely do not understand the growing capability gap of the current CSE fleet. As a result of unclear or nonexistent AvSE policy, the Defense Readiness Reporting System (DRRS) contains highly subjective, unstandardized CSE status reports. MAJCOM managers reported a disconnect unit equipment requests for support, and DRRS report contents. These reports often obscure the current status of assigned CSE assets, as units lack clear guidance for AvSE status reporting.

Finally, decentralized management of AvSE results in hoarding. Units do not trust AFMC's ability to backfill reallocated equipment and are concerned that turned-in equipment impedes a unit's ability to execute their assigned mission. As a result, equipment is hoarded, stockpiled, and pillaged, decreasing the effectiveness of the larger mission.

The consequences of CSE modernization failures are dire. While the loss of American lives may sound hyperbolic, interviewees each expressed concern that AvSE is a blind spot, and will soon degrade each of the nine of the twelve Air Force core functions discussed in Chapter I. In the words of one planning expert: "We don't have the stuff that we need, and the stuff we do have isn't ready."

RQ 3: What actions should Air Force policy-makers take to address those obstacles?

To address the identified obstacles and catalyze CSE modernization, SMEs identified three categories of changes that policy-makers should make. These three

categories, Policy, Resource, and Cultural Changes, all reside within the scope of control of various management organizations. Many of these changes are currently in development by the triad organizations, but require Corporate Structure support to achieve successful implementation. These proposed actions originate from AvSE management experts, and are not primarily attributable to the author.

*Policy Changes*

The first policy change recommended to Air Force leaders is the establishment of written, enterprise-level guidance for AvSE management. Akin to AFI21-101 for Aircraft Maintenance and AFI24-302, a 21-series AvSE AFI would fill the current void by standardizing definitions and modernization processes, providing a standard, objective AvSE DRRS report, and giving AFMC lead command authority. The new policy would also give SPOs a mandate to modernize and consolidate CSE, reducing PSE proliferation and eliminating equipment duplication. This instruction would align AvSE management with the directives of the NSS, NDS, and Air Force policy.

The second recommended policy action was an enterprise-wide sprint to document airframe requirements. Across the Air Force, basic technical specifications and requirements should be recorded for every airframe and maintained independently of their original contractors. This effort would take tremendous manpower but pay dividends during future sustainment efforts. Led by requirements professionals in the A5 and A8 communities, documented requirements would catalyze mission surety. The result of this sprint would be Program Offices providing single sources of data as designed.

One interviewee recommended the realignment of the triad under Air Force Acquisition, giving AvSE managers insight into future programs and priorities. In some ways, CSE modernization shares more similarity with the Acquisition Community than the Logistics Community. This expert argued that organizational links to the needs of the fighter, bomber, mobility, ISR, and weapons acquisition communities would enable modernization efforts. Established lines of coordination would facilitate requirements sharing, enabling the alignment of AvSE requirements under one CSE solution.

A policy requiring a reduction in equipment footprint size, both in size and quantity, may also drive an increased focus on CSE modernization. The ACE mission demands flexibility, but lacks the written policy to change the tactical reality of PSE proliferation.

These policy changes should be undertaken to clarify roles and responsibilities, carefully avoiding creating additional bureaucratic processes to deter progress. As CSE modernization programs succeed, the Air Force will offer more common capabilities, bypassing many of the identified obstacles.

*Resource Changes*

To overcome current obstacles to CSE modernization, managers also recommended resource changes. Financial stability is a critical foundation to CSE modernization and requires a reliable source of funding. Under the Log Panel, modernization advocates should have access to an influential champion, equivalent in rank to other critical programs. Directly enabling nine of twelve Core Functions, CSE needs a dedicated representative singularly focused on portfolio requirements. HAF and

Congressional leaders need to understand the dire condition of AvSE and dedicate reliable funding to avoid mission failure.

Policy changes empowering and tasking AFMC with modernization authority should be coupled with the necessary manpower to execute that tasking. Current manpower levels are unable to balance both daily management and future priorities effectively. To better understand the current need, a manpower study of the MAJCOM should be accomplished.

A final resource change suggested by one interviewee was the standup of an experimentation cell within AFRL. This new team could partner with AFIT and AFMC, both collocated at Wright-Patterson AFB, to work with industry to develop organic CSE solutions. Tasked explicitly with the development of common solutions, the new AFRL cell would possess both inside-access to the Air Force mission and direct lines of communication with industry partners.

*Culture Changes*

The third category of actions to counteract modernization obstacles would require cultural changes. Interservice cross-talk should not only occur in locked vaults, but acquisition and sustainment managers should have open lines of communication within the DoD. For example, the Marines, famously expert at expeditionary operations, could inform Air Force AvSE managers during the current pivot to adaptive basing. One manager described how the Army has standardized "6T" battery technology, presenting attractive applications for Air Force AvSE. Air Force managers of all types should emulate the Operations Community's integration with sister services.

Another cultural change must take place within the Air Force Acquisition Community. For rapid aircraft acquisition to be successful, AvSE managers must be considered and included in the early stages of program development. The current lack of ability to provide input results in vague requirements, late-to-need equipment, and the proliferation of expensive, highly-specialized AvSE.

Finally, field-level logisticians must be willing to accept mission failure under key training conditions to highlight the true nature of the AvSE fleet. The culture of "Flightline Heroics" has allowed the United States total air dominance for the last 30 years but threatens future mission success. Without an accurate picture of capability gaps, resources are misallocated. For the mission to succeed in the future, it must be allowed to fail today.

The proposed policy, resource, and culture changes do not address every aspect of the identified obstacles but would provide practical steps toward a robust, flexible fleet of CSE. Air Force policy-makers have the power to overcome the five CSE modernization obstacles through policy, resource, and cultural changes.

**Summary**

This chapter discussed the results of the data collection process described in Chapter III. The opinions and views of the interviewed SMEs were categorized into five obstacles to CSE modernization: Inadequate Resources, Administrative Structure, Acquisition Management, Communication Breakdowns, and Competing Cultures. Research Question Two uncovered the dire consequences of a pattern of CSE

modernization failures. Finally, Research Question Three summarized the proposed Policy, Resource, and Cultural changes to Air Force decision-makers.

# V. Conclusions and Recommendations

## Conclusions of Research

The $13 billion Common Support Equipment portfolio directly impacts national security by enabling nine of the twelve Air Force Core Functions. Critically out-of-date, the fleet's $2 billion disconnect between current capability and authorized levels has provided a moment of reckoning for AvSE managers. Unable to effectively manage both sustainment and modernization of CSE, insufficient resources have forced AFMC into crisis management.

Subject Matter Experts from Headquarters Air Force, Air Force Materiel Command, Pacific Air Forces, the Air Force Life Cycle Management Center, the Air National Guard, the Air Force Research Laboratory, Acquisition Program Managers, and individual System Program Offices and Weapon Systems Teams identified five obstacles to CSE modernization: Inadequate Resources, Administrative Structure, Acquisition Management, Communication Breakdowns, and Competing Cultures.

For the last fifteen years, the Resources dedicated to AvSE have decreased dramatically, partially as a result of consolidation under Centralized Asset Management and the Support Equipment Transformation. Starved of Investment Funds and reliant on annual Operations and Maintenance dollars, the equipment fleet is frozen in time, unable to both cover current needs and accomplish modernization projects. Competing priorities, coupled with minimal managerial manpower, have relegated resources to a few annual priorities, leading to a fleet-wide readiness decline.

The current AvSE Administrative Structure provides the second obstacle to CSE modernization. A vacuum of strategic vision and authority has produced siloed spending

and allowed Air Combat Command, Global Strike Command, Air Force Special Operations Command, and Air Mobility Command to stonewall the development of common solutions. The absence of enterprise-level management of AvSE blurs lines of communication, results in ambiguous processes, and produces duplicative pieces of equipment. The current Administrative Structure also has resulted in significant data loss. Missing minimum system requirements, usage data, and equipment status obscure the true state of mission capability, and deter the Corporate Structure from approving modernization projects.

The third obstacle, Acquisition Management, obstructs modernization through the misalignment of incentives and through current policies and practices. Acquisition incentives, under pressure from Congress and Headquarters Air Force, prioritize airframes on the ramp, even at the expense of the equipment required to employ those airframes. As a result, the larger fleet has lower capability rates than a smaller, properly equipped fleet.

The prioritization of timeliness also allows defense contractors to corner acquisition professionals into expensive peculiar equipment solutions. Even though AFI63-101 directs Program Managers to maximize the use of common equipment, today's out-of-date CSE fleet enables contractors to circumvent efforts to consolidate and modernize equipment.

Current policies and practices in Acquisition Management counter modernization projects by allowing Program Offices to rely on defense contractors for basic system requirements. Furthermore, no current policy requires Program Offices to collaborate on

CSE requirements. Acquisition Management incentives, policies, and practices must be addressed for CSE modernization efforts to be successful.

Communication Breakdowns are the fourth obstacle to CSE modernization. Managers cited examples of contractors facilitating communication between Air Force organizations, when established lines of communication were unable to reach consensus. Poor communication has resulted in a Corporate Structure impression that CSE does not require significant resources or higher priority. Members of the AvSE management triad expressed frustration that AFWERX, Spark Tank, and other innovation cells do not collaborate during AvSE modernization projects, often leading to an incomplete understanding of the requirements.

The fifth obstacle, Competing Cultures, impedes CSE modernization projects through tribalism, values, and distrust. Hoarding capability at the local level, unit tribalism impacts data integrity, resource allocation, and produces a resistance to change. When units "simulate" equipment during exercises, utilizing resources that would not be available in a wartime scenario, their no-fail culture conceals mission-capability gaps. Finally, triad managers described interorganizational distrust; the tendency of Air Force leaders to prefer grassroots modernization efforts over the projects originating from AFMC.

These five obstacles have resulted in serious consequences to the Air Force's agility, finances, and mission. Though the aging fleet of equipment impacts day-to-day operations on the flightline, more serious consequences lurk beneath the surface. Operating from superbases, the force is anchored to large fleets of peculiar equipment that preclude the agile, flexible force prescribed in the National Security Strategy and the

National Defense Strategy. MAJCOM planners cited AvSE footprints as their single greatest mobility concern during wartime contingency planning. Furthermore, these obstacles have enabled the F-35 to be supported almost entirely by peculiar equipment, sharing marginal commonality with other Air Force assets.

The obstacles to CSE modernization have also resulted in significant financial waste. Expensive catch-up projects neglect opportunities to consolidate capability and have produced 50 to 100 duplicative equipment items. Some of the nation's highest priority assets, like the E4-B, are forced into expensive work-arounds due to unreliable AvSE. When interoperable, modern common equipment items are not available, the acquisition of new airframes leads the Service down a path of increased AvSE cost, complexity, and specificity through additional PSE.

The third, and most serious, consequence as a result of the five obstacles is the erosion of mission surety. Managers of all levels of AvSE management expressed concern that top Air Force leaders may not have an accurate sight picture of the current state of AvSE. The absence of accurate data collection, coupled with vague AvSE policy, have produced highly subjective, unstandardized DRRS reports. Though the Air Force does not use DRRS reports to rate a commander's effectiveness, remnants of past culture discourage complete transparency. Unit tribalism and equipment hoarding further obscure the true state of a vital link in the logistics chain. All interviewed levels of AvSE management expressed a deep concern that CSE is an Air Force blind spot, and will soon degrade the Service's ability to execute its Core Functions.

## Recommendations for Action

Though CSE faces significant obstacles to modernization, and the consequences of an outdated fleet are dire, AvSE managers were confident that focused changes to policy, resources, and culture could adjust the current trajectory. These changes should carefully avoid imposing additional bureaucracy and focus on the removal of roadblocks as the Air Force "Accelerates Change" (Brown, 2020).

To overcome current obstacles, AvSE policy should by codified in a single-source AFI, standardizing definitions and modernization processes, providing uniform data reporting criteria, giving AFMC lead command authority, and requiring thorough coordination during the acquisition process. Furthermore, all AvSE managers strongly recommended that the Air Force buy the complete specifications of every item procured.

To tackle the current lack of system requirements, an enterprise-wide sprint should document airframe requirements. Though significant manpower would be required, the consolidation of requirements would catalyze modernization and sustainment efforts across the force. A final policy change might also require the reduction of equipment proliferation, reducing duplicative items and consolidating to common equipment.

Secondly, managers recommended focused resource changes. The Air Force Corporate Structure should be empowered to inform HAF and Congressional leaders about the current need through improved data management and interpretation. However, decision makes cannot afford to wait until DPAS "solves" the current lack of data. Current AFMC manpower levels preclude concurrent management and modernization of the 533,000 item CSE portfolio. A manpower study of AvSE management organizations

should be accomplished, with clear delineation of roles and responsibilities. With adequate manning, triad organizations will be better equipped to articulate CSE requirements to the Logistics Panel.

Finally, leaders in the logistics enterprise should encourage cultural changes. The Operations community's admirable cross-talk with other service branches should be emulated in both acquisitions and logistics. Marine expeditionary logistics and Army equipment standardization hold valuable corporate knowledge often untapped by Air Force professionals. The culture of siloed thinking should also be addressed in the acquisition community. Though incentives reward speed and cost, each program holds the potential to improve Air Force logistics by capitalizing on modernization opportunities. Finally, Wing-level leaders should clearly articulate the importance of presenting an accurate capability sight picture during exercises and status reports. No unit wants to fail a mission-generation exercise, but to safeguard future mission surety, capability limits and gaps must be identified today.

**Future Research**

The AvSE enterprise is rich with opportunities for future research. Built on the foundation of Bayer (2003), Leighton (2017), and Bobic (2018), a quantitative link between CSE assets and mission capability could be modeled. The impact of PSE on airlift requirements may also provide useful insight. The five obstacles to CSE modernization could each be explored in more detail and evaluated through a survey of the larger logistics enterprise. One interviewee mentioned the environmental impacts of the continued use of the A/M32-60B generator, which emits a deafening roar during use

and consumes large amounts of fuel. The study could focus on technician health, impediments to communication, and sustainment costs of the generator. Modernization could be explored with a wider lens, investigating successful efforts in other Services or Air Force organizations. Finally, a future study could focus on the detailed policy, resource, and cultural changes necessary to enable successful modernization efforts.

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**14. ABSTRACT**
The current fleet of Common Support Equipment (CSE) is faced with a $2B funding disconnect that threatens 9 of the 12 USAF Core Functions. This research identifies the barriers to efforts to modernize CSE across the sustainment, acquisition, and maintenance communities. Using a qualitative, grounded theory methodology, the responses are explored of interviewed Support Equipment managers responsible for the sustainment and modernization of CSE. Significant barriers to current modernization efforts were exposed, resulting in expensive, duplicative, and unreliable equipment; concluding that the AF must change the way CSE is administrated, funded, and culturally understood to prevent future mission degradation.

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